(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 July 2004 (15.07.2004)

PCT

(10) International Publication Number
WO 2004/058513 A1

(51) International Patent Classification[7]: B41J 33/00

(21) International Application Number:
PCT/EP2003/014705

(22) International Filing Date:
22 December 2003 (22.12.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
TO2002A001128
27 December 2002 (27.12.2002) IT

(71) Applicant *(for all designated States except US)*: **EIDOS S.P.A.** [IT/IT]; Corso Matteotti 25, I-10023 Chieri (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **TABASSO, Giovanni** [IT/IT]; Strada Traforo 17, I-10025 Pino Torinese (IT).

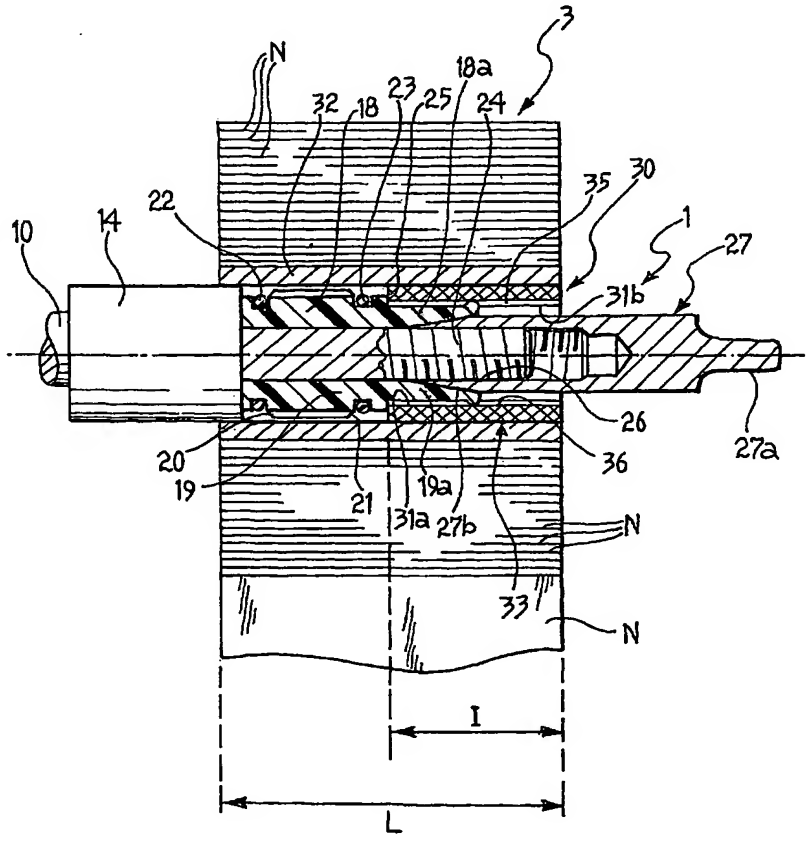
(74) Agents: **QUINTERNO, Giuseppe** et al.; Jacobacci & Partners S.p.A., Corso Regio Parco, 27, I-10152 Torino (IT).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: MACHINE AND RIBBON SPOOL FOR THERMAL TRANSFER PRINTING



(57) Abstract: The machine (M) comprises at least one rotating spindle (1, 2; 1', 2'), and at least one ribbon spool (30) mounted on the said spindle (1, 2; 1', 2') and having an axial passage (31) in which a transversely projecting locating formation (33a) is defined, and at least one transversely re-entrant connecting formation (35, 36). The or each spindle (1, 2; 1', 2') comprises an axial portion (15) on which a ribbon spool (30) is designed to be mounted, and which has a stop shoulder (25) against which the locating formation (33a) of the ribbon spool (30), and at least one transversely projecting element (18a, 19a) able to engage in the connecting formation (35, 36) of the ribbon spool (30), are designed to abut in such a way that the spindle and the spool (30) rotate together.

WO 2004/058513 A1

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Machine and ribbon spool for thermal transfer printing

The present invention relates in general to thermal transfer printing of images on items, such as boxes or packages for products.

In the present description the word "image" is used in its broad sense to mean a text, drawing, logo, bar code or any other two-dimensional graphical representation.

In a first aspect the subject of the present invention is a thermal transfer printing machine of the type known for example from European Patent EP-0 572 999-B1 in the name of this Applicant, and its object is to provide improvements to such a machine.

This and other objects are achieved according to the invention with a thermal transfer printing machine whose salient features are defined in the attached Claim 1.

In another aspect, the subject of the present invention is a ribbon spool for a thermal transfer printing machine, the object being to provide improvements to such a ribbon spool.

This and other objects are achieved according to the invention with a ribbon spool whose main features are defined in the attached Claim 5.

Other aspects, features and advantages of the present invention will become clear in the course of the following detailed description, given purely by way of non-restrictive example, with reference to the appended drawings, in which:

Figure 1 is a partial view in front elevation of a ther-

mal transfer printing machine according to the present invention;

Figure 2 is a partial view on a larger scale, taken on the section plane marked II-II in Figure 1;

Figure 3 is a partially sectioned view of a spindle used in the machine according to Figure 1;

Figure 4 is a cross section view taken on the plane marked IV-IV in Figure 3;

Figure 5 is a perspective view of the spindle shown in Figures 2 and 3;

Figure 6 is a front view of a ribbon spool according to the present invention;

Figure 7 is a view in section taken on the plane marked VII-VII in Figure 6;

Figure 8 is a front view that shows a ribbon spool according to the present invention;

Figure 9 is a view in section on the plane marked IX-IX in Figure 8; and

Figure 10 shows an insert for a ribbon spool according to the invention.

In Figure 1, M is a general reference for a machine for the printing of images by thermal transfer according to the present invention.

In the embodiment illustrated by way of example, this machine comprises a supporting structure S in which rotatable spindles 1 and 2 carry reels 3 and 4, respectively, on which an auxiliary or receiving ribbon N and an inked ribbon R, respectively, are wound, for carrying out printing methods of the type described in the abovementioned European Patent.

The ribbons R and N are of essentially the same width and

follow respective predetermined paths in the machine M.

In the embodiment illustrated by way of example, the ribbons N and R are brought together downstream of their respective winding reels 3 and 4 at a first turn roller R1 and then pass together between another turn roller R2 and a thermal dot-line print head H, of a type known per se. Downstream of this print head the inked ribbon R is again deflected by a roller R3 and then continues towards a thermal transfer device (not shown) of a type known per se, for example of the heated transfer roller or pad type. On returning from the thermal transfer device, the ribbon R passes around turn rollers R4 and R5, and finally comes to a rewinding reel, marked 6 in Figure 1, mounted on a driven spindle 2'.

Downstream of the deflection roller R2 the auxiliary ribbon N runs on past another deflection roller R6 to a rewinding reel 5 mounted on a driven spindle 1'.

Advantageously, the spindles 1 and 2 that carry the reels 3 and 4 (and the rewinding spindles 1' and 2') are made as will now be described with reference to Figures 2 to 5, and correspondingly the reels 3 and 4 (and the reels 5 and 6) comprise respective ribbon spools 30 advantageously made as will be described with reference to Figures 2 and 6 to 10.

Referring particularly to Figures 2 and 3, a spindle 1 of this kind essentially comprises a shaft 10 mounted rotatably via a bearing 11 in a retaining element 12 fixed to the supporting structure S by means of screws 13.

The shaft 10 has a cylindrical portion 14 of enlarged diameter integral with an intermediate portion 15, also cylindri-

cal, of the spindle. Two diametrically opposite longitudinal slots marked 16 and 17 are formed in the intermediate portion 15 of the spindle. These slots, which may advantageously have an essentially rectangular cross section, each receive a key element 18 and 19, respectively (see in particular Figures 2 to 4).

As can be seen more clearly for example in Figures 3 and 5, two circumferential and axially separate grooves 20 and 21 are formed in the intermediate portion 15 of the spindle 1. Elastic sealing rings 22, 23, respectively, are engaged in these grooves. These rings act elastically on the key members 18 and 19 to keep them in contact with the bottom walls of the slots 16 and 17 of the intermediate portion 15 of the spindle.

Away from the head 14, the intermediate portion 15 of the spindle meets a terminal axial portion 24 of the spindle, having a reduced diameter, a shoulder 25 being formed in the transition (see for example Figure 5).

The key members 18 and 19 have respective end portions 18a and 19a that extend along the axial portion 24 of the spindle 1, to which they present respective shaped profiles or inclined planes 18b and 19b.

The axial portion 24 of the spindle has an external thread 26 on which a tapped part 27 is screwed. Advantageously, but not necessarily, the free end 27a of the tapped part has a squashed, essentially plate-like configuration that can easily be gripped for screwing or unscrewing the said tapped part onto or off the threaded portion 26 of the spindle.

The opposite end 27b of the tapped part 27 advantageously has a conical outer surface (Figure 3).

When the tapped part 27 is screwed onto the threaded shank 24 of the spindle, the end 27b of the tapped part is able to engage against the inclined planes 18b and 19b of the key members 18 and 19. This essentially pushes the key members apart in a generally radial direction, towards the exterior, for reasons which will become clearer later.

With reference to Figures 2, 6 and 7, in the embodiment illustrated the reel 3 of auxiliary ribbon N comprises a ribbon spool which has the general reference 30.

This spool 30 has an essentially cylindrical tubular general form with an axial passage 31 running through it to accommodate the spindle 1.

In the embodiment illustrated the ribbon spool 30 comprises a cylindrical tubular core 32 of e.g. pressboard, on which the auxiliary ribbon N is prewound, and a cylindrical tubular insert 33 made of an essentially more rigid material, e.g. moulded plastic.

The insert 33 is shorter than the core 32 and is fixed inside the latter by for example driving it in axially with radial interference in such a way that its end 33a located furthest inside the core 32 defines an annular locating shoulder designed to meet the shoulder 25 of the spindle 1.

Advantageously, as seen in Figure 10, the insert 33 may be provided with a plurality of peripheral projections 34, such as ribs or fluting, for digging into the inside surface of

the core 32 and improving the grip between the two.

Referring to Figures 6 and 7, in the inside surface of the insert 33, two diametrically opposite slots 35 and 36 are made.

Due to the presence of the insert 33, the axial passage 31 defined in the ribbon spool 30 effectively has a first portion 31a of larger diameter, and a second portion 31b of smaller diameter. These portions of the passage 31 meet at the shoulder 33a formed by the innermost end of the insert 33 (Figure 7).

Referring to Figure 2, the total length L of the ribbon spool 30, that is the length of the core 32, is such that when the spool is placed on the spindle 1 the tapped part 27 partly protrudes from the spool.

The reel 3 of auxiliary ribbon N can be pushed onto the spindle 1 until the shoulder 33a of the spool meets the corresponding reference and stop shoulder 25 of the spindle 1. When connected, the end portions 18a, 19a of the key members 18 and 19 of the spindle extend along the slots 35 and 36, respectively, of the insert 33, forming a prismatic coupling between the spool 3 and the spindle 1. By turning the tapped part 27 it is thus possible to radially open the ends 18a and 19a of the key members 18 and 19 against the bottom walls of the slots 35 and 36 of the spool 30 for effective clamping, so that the spool 3 and the spindle 1 are held firmly together when rotated.

As will be clear from the above description, the shoulder 33a and the slots 35 and 36 of the ribbon spool are such that the

spindle 1 can be connected to the reel 3 only by introducing this spindle through the large-diameter end 31a of the axial passage 31.

Referring to Figure 2, the length I of the insert 33 is equal to half the length L of the core 32. This feature ensures that the reel 3 is central when positioned on the spindle 1, relative to the shoulder 25, independently of the width L of the ribbon N used.

The axial passage 31 through the ribbon spool, with its change of cross section, ensures that the reel 3 cannot be mounted on the spindle the wrong way round. This feature is particularly helpful in a machine such as that shown in Figure 1, where the auxiliary ribbon N and the inked ribbon R are prewound in opposite directions on their respective ribbon spools, and are therefore intended to unwind in use in opposite directions (see Figure 1, and also compare Figures 6 and 7 relating to the reel 3 of auxiliary ribbon N with Figures 8 and 9 which relate instead to the reel 4 of inked ribbon R).

The solution described thus far is particularly advantageous as it makes it possible to use reels of auxiliary ribbon N or inked ribbon R of standard type, usually produced on a tubular cylindrical core, of e.g. pressboard, with a constant diameter of its internal passage. In this case it is advantageously possible to insert a respective insert, such as the insert 33 described earlier, into the cores of these reels.

Advantageously, the inserts 33 of the reels 3 and 4 of auxiliary ribbon N and inked ribbon R, respectively, have a visible feature, such as colour, which they share with the corre-

sponding spindle 1 or 2 (or at least part thereof, such as the tapped part 27), this characteristic being different for the two spindles 1 and 2 and for the cores 33 of the respective ribbon spools. For example, cores 33 of spools carrying the auxiliary ribbon N and the tapped part 27 of the corresponding spindle 1 may be red, while cores 33 and spools carrying the inked ribbon R and the tapped part 27 of the corresponding spindle 2 may be black.

In an alternative embodiment (not shown) the ribbon spools for the reels of auxiliary ribbon and inked ribbon may be made in one piece, e.g. a single plastic moulding, with an overall shape corresponding to the unit formed by the core 32 and insert 33 of the spools 30 described above.

The above description also applies to the spindles 1′ and 2′ and the associated ribbon rewinding spools. When in use, the spools 30 of the reels of ribbon 3 and 4, once fully unwound, can be removed from the spindles 1 and 2 and mounted on the spindles 1′ and 2′ (the reels of rewound ribbon having first been removed), allowing them to be used as rewinding spools in the next operation.

Clearly, without departing from the principle of the invention, the embodiments and the construction details may differ greatly from those described and illustrated purely by way of non-restrictive example, without their departing from the scope of the invention, as defined in the accompanying claims.

CLAIMS

1. Thermal transfer printing machine (M) comprising

at least one rotating spindle (1; 2; 1', 2'), and

at least one ribbon spool (30) mounted on the said spindle (1, 2; 1', 2') and having an axial passage (31) in which a transversely projecting locating formation (33a) is defined, and at least one transversely re-entrant connecting formation (35, 36);

the spindle (1, 2; 1', 2') comprising

an axial portion (15) on which a ribbon spool (30) is designed to be mounted; the said axial portion (15) of the spindle having a stop shoulder (25) against which the locating formation (33a) of the ribbon spool (30) is designed to abut; and

at least one transversely projecting element (18a, 19a) able to engage in the connecting formation (35, 36) of the ribbon spool (30) in such a way that the spindle and the spool (30) rotate together;

the arrangement of the locating (33a) and connecting (35, 36) formations of the spool (30), and of the stop shoulder (25) and of the projecting element (18a, 19a) of the spindle being such that the ribbon spool (30) is connectable to the spindle simply by inserting the spindle through a predetermined end (31a) of the axial passage (31) of the ribbon spool (30).

2. Machine according to Claim 1, in which the spindle (1, 2; 1', 2') is provided with tightening means (26, 27) capable of causing a radial movement of the abovementioned transversely projecting element (18a, 19a) towards the corresponding connecting formation (35, 36) on the ribbon spool (30) mounted on the spindle; the said tightening means comprising

an actuating member (27) projecting beyond the ribbon spool (30) connected to the spindle.

3. Machine according to Claim 2, in which the spindle (1, 2; 1', 2') has a first and a second axial portions (15, 24) having a larger cross section and a smaller cross section, respectively, between which the abovementioned stop shoulder (25) is defined; at least one longitudinal slot (16, 17) being produced in the first axial portion (15) to take a radially movable key member (18, 19), one end (18a, 19a) of which extends along the said second axial portion (24) of the spindle and has a shaped profile, in particular an inclined plane (18b, 19b);

and in which the said second axial portion (24) of the spindle has a thread (26) on which a tapped part (27) is screwed, a first end (27a) of which projects out of the ribbon spool (30) connected to the spindle, and the second end (27b) of which is able to interact with the said shaped profile (18b, 19b) of the key member (18, 19) in such a way as to bring about a movement of this key member (18, 19) towards the corresponding connecting formation (35, 36) on the ribbon spool (30).

4. Machine according to Claim 3, in which the said first axial portion (15) of the spindle has at least one peripheral groove (20, 21) containing an elastic sealing ring (22, 23) capable of keeping the said key member or members (18, 19) in the corresponding slot or seat (16, 17).

5. Ribbon spool (30) for connection to a spindle (1, 2; 1', 2') of a thermal transfer printing machine (M), comprising

an essentially cylindrical tubular supporting element (32, 33), through which an internal axial passage (31) runs

to accommodate the spindle; a variation of cross section being produced in an axially intermediate portion of the said passage (31) to define a transverse locating formation (33a), against which a reference and stop shoulder (25) on the spindle is designed to abut;

at least one connecting formation (35, 36) being produced in an axial portion (31b) of the said passage (31) and able to connect prismatically with a portion (18a, 19a) of the spindle, in such a way that they rotate together;

the connecting formation (35, 36) and the locating formation (33a) being produced in such a way that the said supporting element (32, 33) is connectable to the spindle purely by inserting the spindle through a predetermined end (31a) of the said axial passage (31).

6. Ribbon spool according to Claim 5, characterized in that it is a monolithic element, that is it is made in one piece.

7. Ribbon spool according to Claim 5, in which the said supporting element (32, 33) comprises

a cylindrical tubular core (32), on the periphery of which a ribbon (N; R) is to be wound, and

an insert (33) of essentially cylindrical tubular shape, which is shorter than the core (32) and is fixed inside the said core (32) in such a way that one of its ends defines the abovementioned locating formation (33a);

the said connecting formation or formations (35, 36) being formed in the inside surface (31b) of the insert (33).

8. Ribbon spool according to Claim 7, in which the said cylindrical tubular core (32) is made of board or the like, and the insert (33) is of a comparatively more rigid material, in particular a plastic material, and is driven with interfer-

ence into the said core (32).

9. Ribbon spool according to Claim 8, in which the insert (33) has at least a plurality of peripheral projections (34), such as ribs or fluting, for digging into the core (32).

10. Ribbon spool according to any one of Claims 7 to 9, particularly for a printing machine (M) having at least two rotating spindles (1, 2; 1', 2') designed to take corresponding spools (30) of identical shape for corresponding ribbons (N, R) of equal width (L) and which in operation are unwound or wound in opposite directions; the said insert (33) being positioned axially in the core (32) in such a way that the end of the insert (33) which defines the abovementioned locating formation (33a) is at the central axial section of the core (32).

11. Ribbon spool according to Claim 10, in which the insert (33) has a length (I) equal to half the length (L) of the core (32).

12. Ribbon spool according to Claim 10 or 11, characterized in that it has a visible feature, such as colour, which it shares with the spindle to which it must be connected in operation; the said feature being different for the two spindles and for the corresponding ribbon spools (30).

13. Ribbon spool according to any one of Claims 5 to 13, in which the said connecting formation or formations is or are a slot (35, 36) formed in the inside surface of a smaller-diameter axial portion (31b) of the abovementioned passage (31).

14. Ribbon spool according to Claim 13, in which there are formed in the smaller-diameter axial portion (31b) of the abovementioned passage (31) two preferably diametrically opposite slots (35, 36) designed to be engaged by respective radial projections (18a, 19a) of the spindle.

15. Reel (3, 4) of ribbon prewound for use in a thermal transfer printing machine (M), characterized in that it comprises a ribbon spool (30) according to one or more of Claims 5 to 14.

FIG. 1

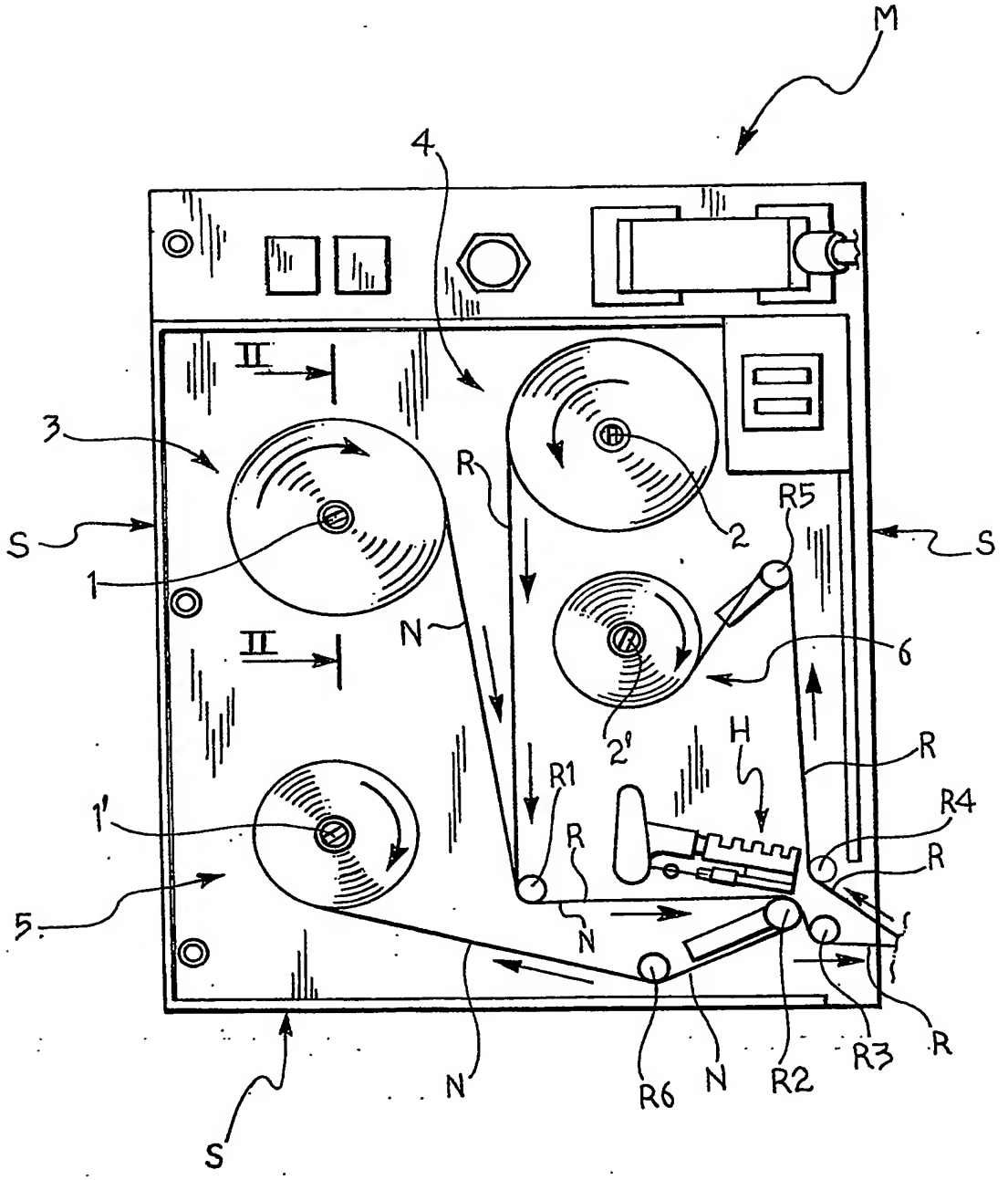


FIG. 2

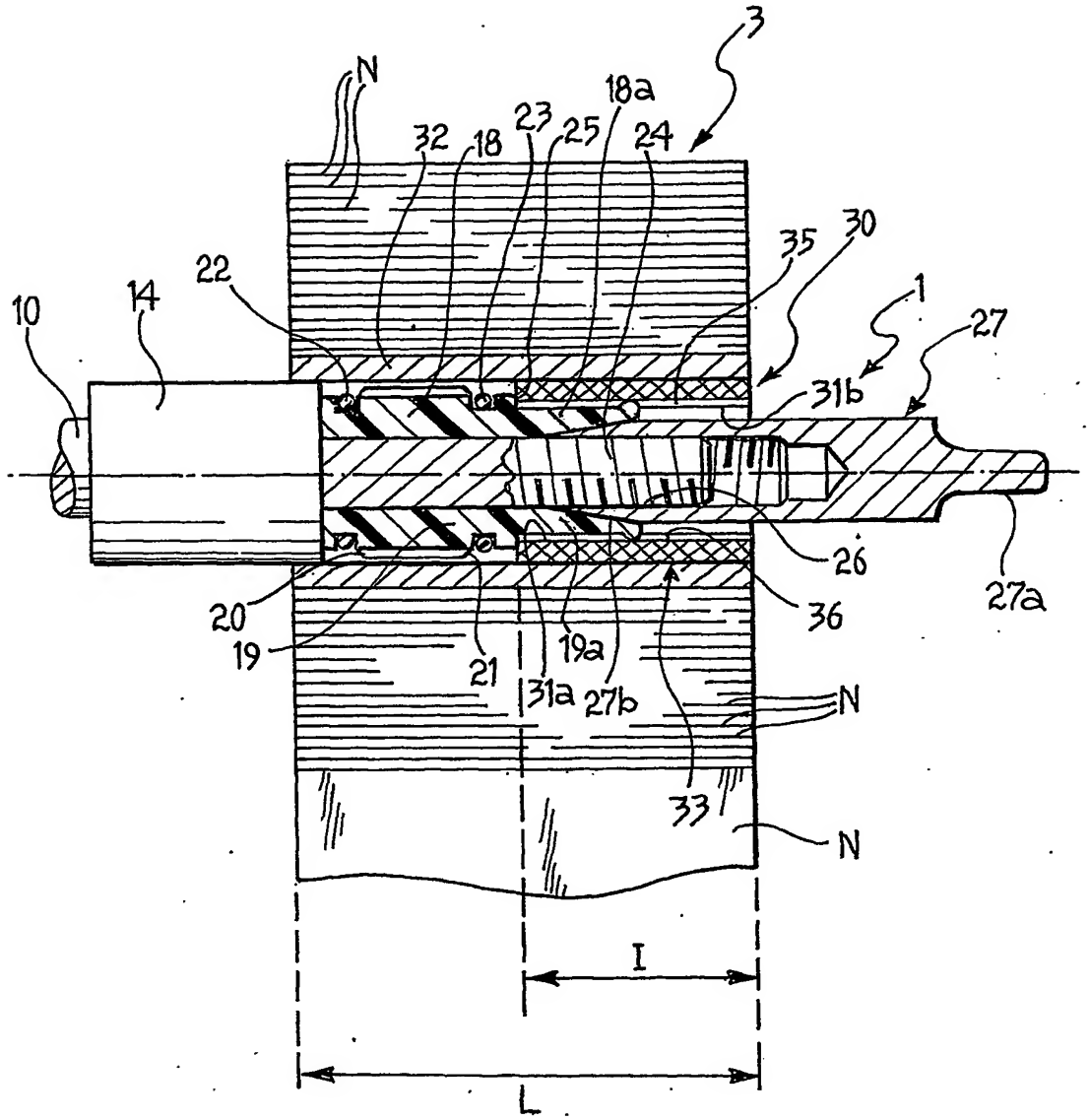

3
N
18a
32
18
23
25
24
35
30
22
1
10
14
27
31b
26
27a
36
20
19
21
19a
31a
27b
N
33
N
I
L

FIG. 3

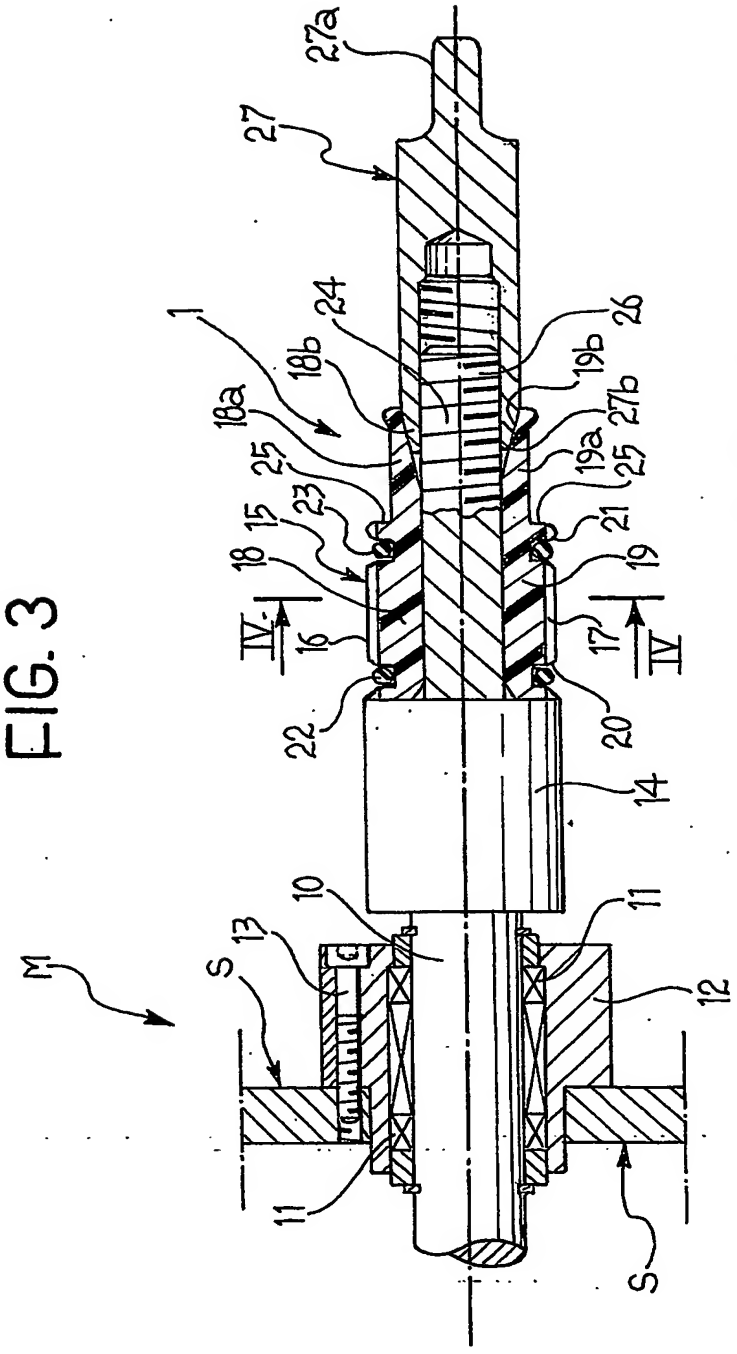

27a
27
1
24
26
18b
19b
18a
27b
25
19a
25
23
15
21
18
19
IV
IV
16
17
22
20
14
10
11
13
M
S
12
11
S

FIG. 4

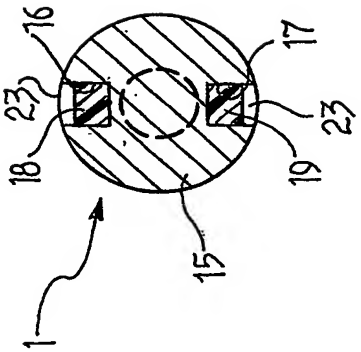

16
17
23
23
18
19
15
1

FIG. 5

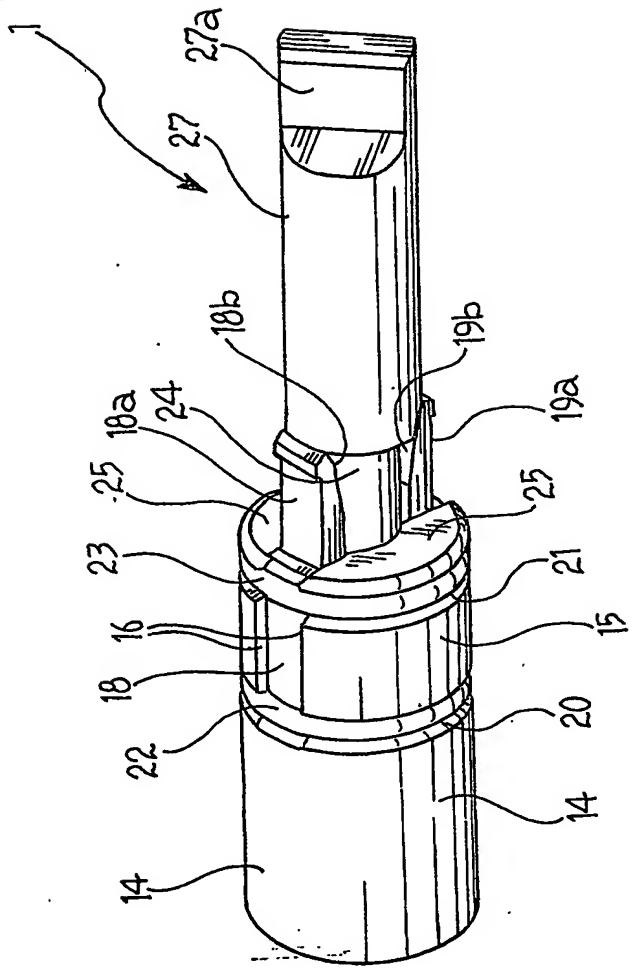


FIG. 7

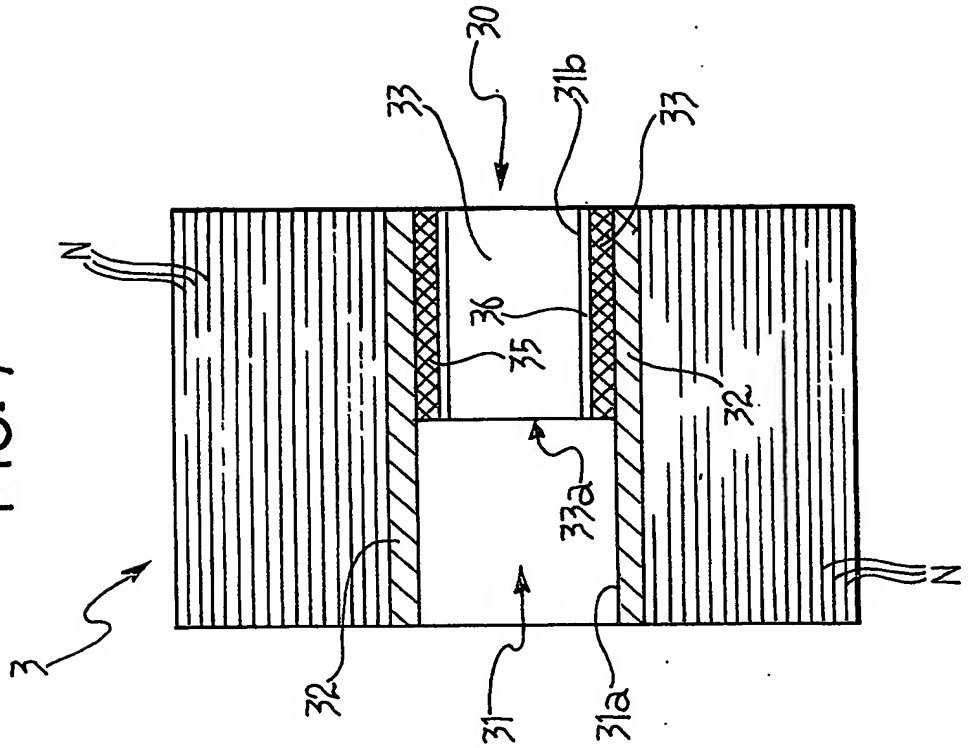


FIG. 6

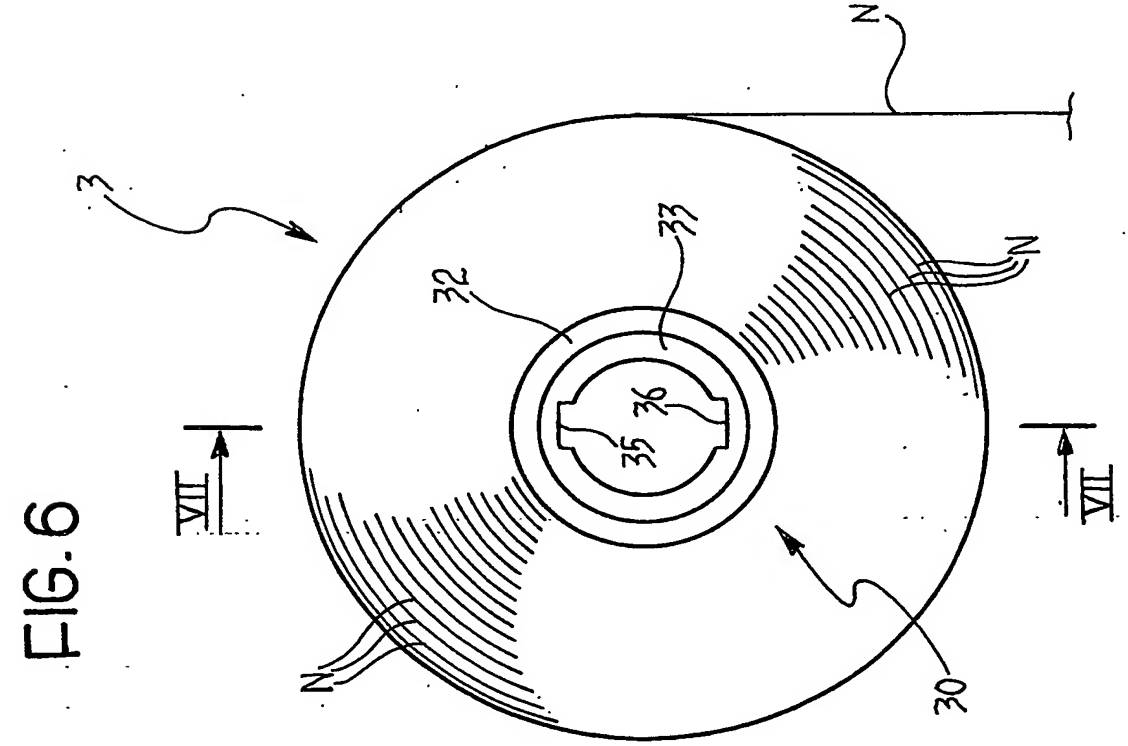


FIG. 9

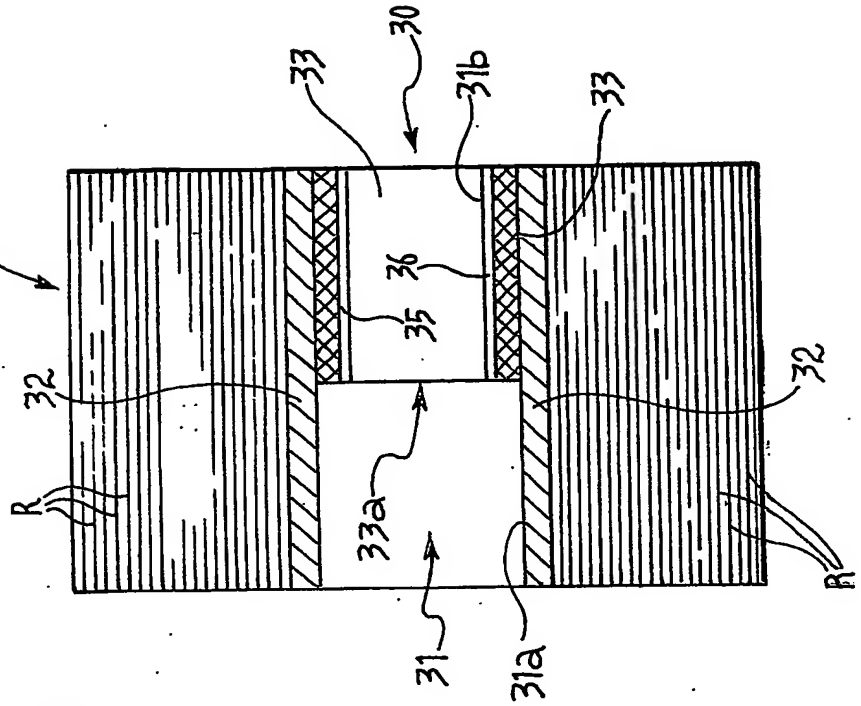


FIG. 10

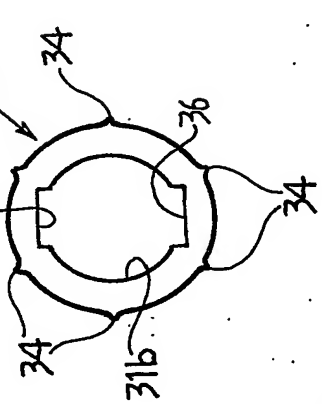
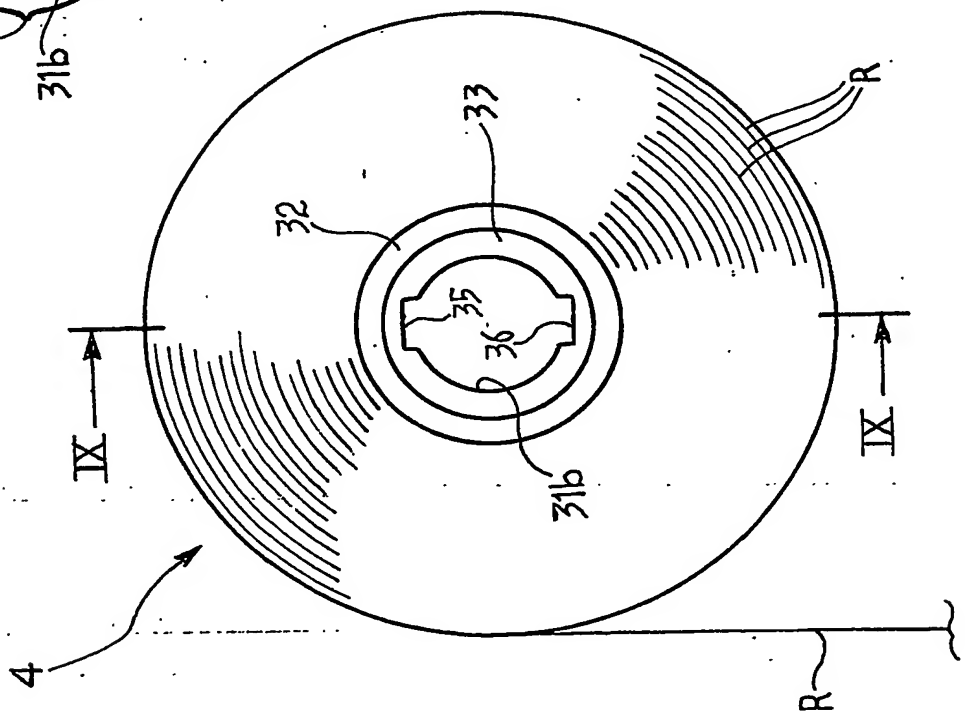


FIG. 8



[redacted]ERNATIONAL SEARCH REPORT

[redacted]ional Application No
PCT/EP 03/14705

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B41J33/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 938 350 A (COLONEL KENNETH) 17 August 1999 (1999-08-17) the whole document	1-15
A	EP 0 609 107 A (BROTHER IND LTD) 3 August 1994 (1994-08-03) the whole document	1-15
A	EP 0 911 178 A (ALPS ELECTRIC CO LTD) 28 April 1999 (1999-04-28) the whole document	1-15

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 May 2004	27/05/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Axters, M

1

Form PCT/ISA/210 (second sheet) (January 2004)

ERNATIONAL SEARCH REPORT

Information on patent family members

tional Application No
PCT/EP 03/14705

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5938350	A	17-08-1999	NONE		
EP 0609107	A	03-08-1994	JP	3066555 B2	17-07-2000
			JP	6227102 A	16-08-1994
			DE	69406023 D1	13-11-1997
			DE	69406023 T2	26-03-1998
			EP	0609107 A2	03-08-1994
			US	5399036 A	21-03-1995
EP 0911178	A	28-04-1999	JP	11115292 A	27-04-1999
			DE	69800421 D1	11-01-2001
			DE	69800421 T2	05-04-2001
			EP	0911178 A1	28-04-1999
			US	6039477 A	21-03-2000